Emily Wong

Energy lesson

Grade level : 6th

Time: 2 classes (45 minutes each)

Source: Adapted from The NEED Project’s Exploring Solar Energy Activity 2

http://www.need.org/

Adapted by Jill Williams as part of the INL Educational Science writing team.

Teacher competency 3C: Engaging students in Learning

NYC Scoping sequence Standards: PS 4.5a,b: Principle of the conservation of energy

PS 4.1a,c,d PS 4.4a,b: Light energy vs. heat energy

AIM: How can radiant energy be absorbed, reflected and converted into heat?

Objectives: Students will:

* Learn what is energy and the different forms
* Understand that energy is never created or destroyed only transformed
* Understand that some of the energy absorbed by object is converted into heat
* Demonstrate that radiant energy can be absorbed or reflected by objects

Do Now: List 5 things you know about energy. (Have students come up with ideas what they think energy is, where it comes from, where does it go, sources etc)

Motivation:

Have a bunch of tools that show the transformation of energy (ex: light hitting a thermometer, fan blowing to an anemometer, outlet plugged in to turn on a radio, circuit hooked up to a voltmeter, light hitting a solar panel etc.) Have students decide how the transformation of energy goes for each model. Reinforce the idea that energy is always transferring from one form to another. It does not get created or destroyed (law of conservation of energy).

Mini Lesson/Science concepts:

* Energy is the ability to do work, the ability to make a change.
* Law of conservation of energy: Energy is never created or destroyed it is only transformed
* Usually the conversion of energy produces some heat, which is considered the lowest form of energy, since it dissipates into the surroundings and is difficult to capture and use again.
* Solar energy: heat from the sun
* Radiant energy is emitted from the sun, along with heat energy. It travels in electromagnetic waves
* Radiant energy includes visible light, x-rays, infrared rays, microwaves, gamma rays, and others.
* When radiant energy hits objects, some of the energy is reflected and some is absorbed and converted into heat. Some objects absorb more radiant energy than others.

Experiment: Creating radiant energy into heat using radiation cans

Materials:

* 10 cans – 5 painted black, 5 regular metal (Soup size is about right or pint size paint cans.
* 10 lids with holes for the rubber stoppers
* 10 rubber stoppers (The kind with the hole in the middle to put the thermometer through.)
* 10 thermometers
* Pitchers of hot water
* Pitchers of cold water
* 1 or 2-5 Overhead projectors or heat lamps

Procedure:

1. Paint 5 cans and lids black. Drill holes in center just smaller than the size of the stopper.

2. Create 5 stations in class. At each station have 2 cans (1 black, 1 silver) and the lids and stoppers to go with them, 2 thermometers and a light source. Have hot and cold water ready.

**3.** Have each group start by inserting the thermometers into the cans and positioning the stoppers so the thermometers don’t touch the bottom. Record the temperature in both Fahrenheit and Celsius on data table.

**4.** Place the cans under the artificial light(s). Record the temperature after 5 minutes.

**5.** Open the cans and allow the air inside to return to the original temperature.

**6.** Have students place their cans in a sunny location in classroom. Have the students predict what will happen. After five minutes, record the temperatures of the cans.

**7.** Open the cans and allow the air inside to return to the original temperature.

**8.** Fill both of the cans with 200 ml of cold water and record the temperatures. Place the cans in a sunny place. Predict what will happen. Record the temperatures after 5 minutes.

**9.** Fill both of the cans with 200 ml of hot water and record the temperatures. Place the cans in a sunny place. Predict what will happen. Record the temperatures after 5 minutes.

**10.** Have the students look at their data table and answer the questions. (see lab sheet)

Assessment: Data table and conclusions

(Worksheet to give students)

**RADIATION CANS**

Procedure:

**Step 1**: Put thermometers into the black and silver cans and position the stoppers so they are not touching the bottom of the cans. Record the temperatures of both the cans in Celsius and Fahrenheit.

**Step 2:** Place the cans under the bright artificial light, such as an overhead projector or heat lamp. Predict what will happen. Record the temperature of both cans after 5 minutes.

**Step 3:** Open the cans and allow the air inside to return to the original temperature. Place the cans in a sunny place. Predict what will happen. Record the temperatures of both cans after 5 minutes.

**Step 4:** Using your beaker, measure out 200 ml of cold water. Pour 200 ml of cold water into each can. Record the temperatures. Place the cans in a sunny place. Predict what will happen. Record the temperatures after 5 minutes. Dump out the water.

**Step 5:** Using your beaker, measure out 200 ml of hot water. Pour 200 ml of hot water into each can. Record the temperatures. Place the cans in a sunny place. Predict what will happen. Record the temperatures after 5 minutes. Dump out the water.

**RECORD THE DATA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **AIR** | | | | | | **COLD WATER** | | | | **HOT WATER** | | | |
| ORIGINAL | | SUN 5 MIN | | LIGHT 5 MIN | | ORIGINAL | | SUN 5 MIN | | ORIGINAL | | SUN 5 MIN | |
| C | F | C | F | C | F | C | F | C | F | C | F | C | F |
| BLACK  CAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SILVER  CAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

CONCLUSIONS: Look at you data. What have you learned about converting radiant energy into heat? About reflection and absorption of radiant energy?

1. Silver and black cans:
2. Solar and artificial light:
3. Air and water:
4. Cold and hot water:

Discussion/Conclusion: Share data and results with class.

Rubric for assessment:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CATEGORY | **4** | **3** | **2** | **1** |
| **Scientific Knowledge** | Explanations by all group members indicate a clear and accurate understanding of scientific principles underlying the construction and modifications. | Explanations by all group members indicate a relatively accurate understanding of scientific principles underlying the construction and modifications. | Explanations by most group members indicate relatively accurate understanding of scientific principles underlying the construction and modifications. | Explanations by several members of the group do not illustrate much understanding of scientific principles underlying the construction and modifications. |
| **Plan** | Plan is neat with clear measurements and labeling for all components. | Plan is neat with clear measurements and labeling for most components. | Plan provides clear measurements and labeling for most components. | Plan does not show measurements clearly or is otherwise inadequately labeled. |
| **Construction -Materials** | Appropriate materials were selected and creatively modified in ways that made them even better. | Appropriate materials were selected and there was an attempt at creative modification to make them even better. | Appropriate materials were selected. | Inappropriate materials were selected and contributed to a product that performed poorly. |
| **Data Collection** | Accurate and careful data taken for air, cold water and hot water cans | Pretty accurate data taken for air, cold water and hot water cans | Inaccurate data taken in some cases for air, cold and hot water cans | Data not taken carefully OR not taken in a reliable manner. |
| **Conclusions** | Answers all conclusion questions thoroughly, showing accurate understanding of the lab. | Answers all conclusion questions thoroughly, showing satisfactory understanding of the lab. | Answers most of the conclusion questions thoroughly, showing satisfactory understanding of the lab. | Conclusion questions show minimal understanding of the lab. |